

1 CLAIMS:

2 1. A plasma etching process comprising:
3 forming a carbon containing material over a semiconductor
4 substrate; and

5 plasma etching the carbon containing material from the substrate
6 at a temperature of at least 400°C using a hydrogen or oxygen
7 containing plasma.

8
9 2. The plasma etching process of claim 1 wherein the
10 temperature is at least 600°C.

11
12 3. The plasma etching process of claim 1 wherein the plasma
13 contains hydrogen and oxygen.

14
15 4. The plasma etching process of claim 1 wherein the plasma
16 contains oxygen.

17
18 5. The plasma etching process of claim 1 wherein the plasma
19 contains hydrogen.

20
21 6. The plasma etching process of claim 5 wherein the hydrogen
22 containing plasma is derived at least in part from H₂.

1 7. The plasma etching process of claim 5 wherein the hydrogen
2 containing plasma is derived at least in part from NH_3 .

3
4 8. The plasma etching process of claim 5 wherein the carbon
5 containing material comprises a polymer.

6
7 9. The plasma etching process of claim 1 wherein the plasma
8 is predominately comprised of hydrogen.

9
10 10. The plasma etching process of claim 1 further comprising
11 after said plasma etching, further plasma etching using a gas comprising
12 chlorine.

13
14 11. The plasma etching process of claim 10 further comprising
15 after said plasma etching, further plasma etching using a gas comprising
16 a mixture of chlorine and hydrogen.

17
18 12. The plasma etching process of claim 10 further comprising
19 after said plasma etching, further plasma etching using a gas comprising
20 a mixture of Cl_2 and H_2 .

21
22 13. The plasma etching process of claim 10 wherein the chlorine
23 is derived at least in part from Cl_2 .

1 14. The plasma etching process of claim 10 wherein the chlorine
2 is derived at least in part from HCl.

3
4 15. A plasma etching process comprising:
5 forming a masking layer over a substrate;
6 patterning the masking layer to form openings therein;
7 first etching material beneath the masking layer through the
8 openings;

9 after the first etching, removing the masking layer from the
10 substrate; and

11 after the removing and before subsequently depositing any material
12 over the substrate, plasma etching the substrate at a temperature of at
13 least 400°C.

14
15 16. The plasma etching process of claim 15 wherein the plasma
16 comprises oxygen.

17
18 17. The plasma etching process of claim 15 wherein the plasma
19 comprises hydrogen.

20
21 18. The plasma etching process of claim 17 wherein the
22 hydrogen containing plasma is derived at least in part from H₂.

1 19. The plasma etching process of claim 17 wherein the
2 hydrogen containing plasma is derived at least in part from NH_3 .

3
4 20. The plasma etching process of claim 15 wherein the plasma
5 is predominately comprised of hydrogen.

6
7 21. The plasma etching process of claim 15 wherein the
8 temperature is at least 600°C .

9
10 22. The plasma etching process of claim 15 wherein the first
11 etching leaves a residue at least partially over the substrate, the plasma
12 etching removing the residue from the substrate.

13
14 23. The plasma etching process of claim 15 comprising after the
15 removing and before subsequently depositing any material over the
16 substrate, conducting at least two plasma etchings using different reactive
17 gas chemistries, one of the at least two plasma etchings being said
18 plasma etching at a temperature of at least 400°C , another of the at
19 least two plasma etchings being subsequent to the one and using a gas
20 chemistry comprising chlorine.

21
22 24. The plasma etching process of claim 23 wherein the another
23 plasma etching is conducted at a temperature of at least 400°C .

1 25. A semiconductor plasma etching process comprising:
2 first etching material from a substrate and forming an undesired
3 residue at least partially over the substrate during the first etching; and
4 after the first etching and before subsequently depositing any
5 material over the substrate, plasma etching the undesired residue from
6 the substrate.

7
8 26. The plasma etching process of claim 25 wherein the first
9 etching comprises dry etching.

10
11 27. The plasma etching process of claim 25 wherein the first
12 etching comprises wet etching.

13
14 28. The plasma etching process of claim 25 wherein the residue
15 comprises a carbon containing polymer.

16
17 29. The plasma etching process of claim 25 wherein the residue
18 is not a polymer.

19
20 30. The plasma etching process of claim 25 wherein the plasma
21 etching is conducted at a temperature of at least 400°C.

22
23 31. The plasma etching process of claim 25 wherein the plasma
24 etching is conducted at a temperature of at least 600°C.

1 32. The plasma etching process of claim 25 wherein the plasma
2 etching is conducted substantially selective to remove the residue relative
3 to all other exposed material of the substrate.

4
5 33. The plasma etching process of claim 25 wherein the residue
6 comprises a carbon containing polymer, and the plasma etching is
7 conducted at a temperature of at least 400°C.

8
9 34. The plasma etching process of claim 25 wherein the residue
10 comprises a carbon containing polymer, and the plasma etching is
11 conducted at a temperature of at least 600°C.

12
13 35. A plasma etching process comprising:
14 forming a photoresist layer over a semiconductor substrate;
15 patterning the photoresist layer to form openings therethrough;
16 dry etching a first layer immediately beneath the photoresist layer
17 through the openings and forming a carbon containing polymer residue
18 at least partially over the substrate during the first etching;

19 after the dry etching, removing the photoresist layer from the
20 substrate; and

21 after the removing and before subsequently depositing any material
22 over the substrate, plasma etching the carbon containing polymer residue
23 from the substrate substantially selectively relative to the first layer.
24

1 36. The plasma etching process of claim 35 wherein the plasma
2 etching is conducted at a temperature of at least 400°C.

3
4 37. The plasma etching process of claim 35 wherein the plasma
5 etching is conducted at a temperature of at least 600°C.

6
7 38. The plasma etching process of claim 35 wherein the plasma
8 comprises oxygen.

9
10 39. The plasma etching process of claim 35 wherein the plasma
11 comprises hydrogen.

12
13 40. The plasma etching process of claim 39 wherein the plasma
14 is derived at least in part from H_2 .

15
16 41. The plasma etching process of claim 39 wherein the plasma
17 is derived at least in part from NH_3 .

1 42. A chemical vapor deposition process of depositing a material
2 over a semiconductor substrate comprising:

3 positioning a semiconductor substrate within a plasma enhanced
4 chemical vapor deposition reactor;

5 plasma etching the substrate within the reactor using a first gas
6 chemistry; and

7 after the plasma etching, chemical vapor depositing a material
8 over the semiconductor substrate within the reactor using a second gas
9 chemistry without removing the substrate from the reactor between the
10 etching and the depositing.

11
12 43. The plasma etching process of claim 42 wherein the plasma
13 etching and the depositing are conducted at subatmospheric pressure, the
14 substrate not being exposed to atmospheric pressure intermediate the
15 plasma etching and the depositing.

16
17 44. The plasma etching process of claim 42 wherein the plasma
18 etching is conducted at a temperature of at least 400°C.

19
20 45. The plasma etching process of claim 42 wherein the plasma
21 etching is conducted at a temperature of at least 600°C.

22
23 46. The plasma etching process of claim 42 wherein the first
24 chemistry comprises oxygen.

1 47. The plasma etching process of claim 42 wherein the first
2 chemistry comprises hydrogen.

3
4 48. The plasma etching process of claim 42 wherein the
5 substrate has a residue formed at least partially thereover the result of
6 previous processing, the plasma etching removing the residue from the
7 substrate.

8
9 49. The plasma etching process of claim 42 wherein the
10 substrate has a carbon containing polymer formed at least partially
11 thereover, the plasma etching removing the carbon containing polymer
12 from the substrate.

13
14 50. The plasma etching process of claim 42 wherein the
15 substrate has a carbon containing polymer residue formed at least
16 partially thereover the result of previous processing, the plasma etching
17 removing the carbon containing polymer residue from the substrate.

18
19 51. The plasma etching process of claim 42 comprising plasma
20 etching the substrate within the reactor using another gas chemistry
21 different from the first and second gas chemistries intermediate the
22 plasma etching with the first gas chemistry and the depositing.

23

24

1 52. The plasma etching process of claim 51 wherein the another
2 gas chemistry comprises chlorine.

3
4 53. The plasma etching process of claim 52 wherein the another
5 gas chemistry comprises hydrogen.

6
7 54. A method of forming a conductive contact comprising:
8 forming an insulative material over a silicon comprising substrate;
9 forming an opening into the insulative material over a node
10 location on the silicon comprising substrate to which electrical
11 connection is desired;

12 first plasma etching within the opening using a gas chemistry
13 comprising hydrogen and exposing silicon of the substrate to said plasma
14 hydrogen;

15 after the first plasma etching, second plasma etching within the
16 opening using a gas chemistry comprising chlorine; and

17 after the second plasma etching, forming a silicide material within
18 the opening in contact with silicon of the substrate.

19
20 55. The method of claim 54 wherein the silicide material is
21 formed by refractory metal deposition and anneal.

22
23 56. The method of claim 54 wherein the silicide material is
24 formed by chemical vapor deposition of the silicide material.

1 57. The method of claim 54 wherein the gas chemistry
2 comprising hydrogen comprises H_2 .

3
4 58. The method of claim 54 wherein the gas chemistry
5 comprising chlorine comprises Cl_2 .

6
7 59. The method of claim 54 wherein the gas chemistry
8 comprising chlorine comprises HCl .

9
10 60. The method of claim 54 wherein the first plasma etching,
11 the second plasma etching, and at least some of the silicide material
12 forming all occur in the same chamber.